

Before the  
**FEDERAL COMMUNICATIONS COMMISSION**  
Washington, DC 20554

In the Matter of

Petition for Waiver of Rules 27.53(n) and  
2.947(f)

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Docket No. \_\_\_\_\_

**ERICSSON PETITION FOR WAIVER**

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**ERICSSON PETITION FOR WAIVER**

**I. INTRODUCTION AND SUMMARY**

Ericsson, pursuant to Section 1.3 of the Commission’s rules,<sup>1</sup> respectfully requests the Commission to grant a waiver of Section 27.53(n) of its rules<sup>2</sup> to enable Ericsson to manufacture and market multiband radios and allow wireless providers that hold spectrum licenses in the 3.45 GHz Service (3.45-3.55 GHz) and the 3.7 GHz Service (3.7-3.98 GHz) to operate them. The multiband radio will serve the public interest by allowing Ericsson to introduce an innovative radio design, including more flexibility to operate in mid-band frequencies, with smaller, more energy-efficient, and more economical base stations, and with no adverse effects on nearby band operations. The relief sought will allow 3.45 GHz out-of-band emission (“OOBE”) levels in the 3.7-4.0 GHz frequencies at the 3.7 GHz Service OOBE levels.

Ericsson manufactures 5G radios in the U.S., is boosting its U.S. investments in R&D, and is currently deploying 5G networks or has publicly announced contracts to do so with eight

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<sup>1</sup> 47 C.F.R. § 1.3.

<sup>2</sup> *Id.* § 27.53(n) (setting forth emission limits for stations transmitting in the 3450-3550 MHz band).

wireless providers in the U.S.<sup>3</sup> Ericsson's Mobility Report (November 2021) reports that 20 percent of all mobile subscriptions in North America were already 5G at the end of 2021 and projects that 90 percent will be 5G in 2027.<sup>4</sup> The highly successful auctions in the 3.7 GHz and 3.45 GHz bands demonstrate the need to support 5G in mid-band spectrum, which offers attractive capacity and coverage capabilities.

Ericsson proposes to develop a radio with a dual-band filter with two passbands, spanning the 3.45-3.55 GHz band and the 3.7-3.98 GHz band, respectively. This will allow a multiband radio solution that utilizes a multiband power amplifier capable of transmitting (i) in standalone 3.7 GHz spectrum or (ii) with carrier aggregation, in both the 3.7 GHz and 3.45 GHz bands simultaneously. With this radio, wireless providers that hold licenses in both bands will be able to deploy in these two bands in a cost- and energy-efficient manner.

Ericsson's proposed radio will conform to the 3.45 GHz Service rules' OOB stepdown across the entire CBRS band (3.55-3.7 GHz), in spectrum below 3.45 GHz, as well as above 4 GHz.

The only relief Ericsson seeks with this waiver request is for when the multiband device transmits in carrier aggregation mode with 3.7 GHz and 3.45 GHz operations, and only with respect to 3.45 GHz Service OOB levels in the 3.7-4.0 GHz band. The dual-filter design will

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<sup>3</sup> See Ericsson, *Ericsson USA 5G Smart Factory*, <https://www.ericsson.com/en/about-us/-company-facts/ericsson-worldwide/united-states/5g-smart-factory> (last visited Mar. 2, 2022); Press Release, Ericsson, *Ericsson announces new Cloud Native and Orchestration Center in North America* (Oct. 5, 2021), <https://www.ericsson.com/en/press-releases/6/2021/10/ericsson-announces-new-cloud-native-and-orchestration-center-in-north-america>; Ericsson, *Ericsson Publicly announced 5G contracts*, <https://www.ericsson.com/en/5g/contracts> (last visited Mar. 2, 2022).

<sup>4</sup> Ericsson, *Ericsson Mobility Report*, at 11 (Nov. 2021), <https://www.ericsson.com/4ad7e9/-assets/local/reports-papers/mobility-report/documents/2021/ericsson-mobility-report-november-2021.pdf>.

cause the radio to exceed the 3.45 GHz OOB limits in the frequency range 3.7-4.0 GHz. In this case, the multiband radio will comply with the OOB limit for the 3.7 GHz Service operations for signals in the 3.7-3.98 GHz band, but not the OOB limit for the 3.45 GHz Service in those frequencies. To be clear, this is a single band certification issue. Out of an abundance of caution, Ericsson also requests a conforming waiver of Section 2.947(f)<sup>5</sup> to allow the device to be equipment authorized pursuant to the limited waiver of Section 27.53(n).

With the dual radio design, 3.7 GHz signals—whether in standalone mode or carrier aggregation with 3.45 GHz signals—will produce lower OOB levels into the CBRS band than would otherwise be the case for 3.7 GHz signals in a single-band radio. In addition, the proposed multiband radios will not operate using the 3.45 GHz carrier only. Instead, 3.45 GHz operations will be in carrier aggregation mode with 3.7 GHz Service frequencies and will involve the transmission of a single composite waveform representing individual physical 5G NR (New Radio) carriers in each of the bands.

Further ensuring that there will be no adverse effects, Ericsson emphasizes that this multiband radio will also meet the OOB commitments Ericsson has made for 3.7 GHz Service devices with respect to emissions into the 4.2-4.4 GHz band. Finally, the radio will conform with the protection requirement for satellite earth stations.

Across multiple Administrations, the United States government has committed to U.S. leadership in 5G, and Ericsson is seeking the FCC's help to meet this pivotal moment in 5G deployment. It is important that Commission policies keep pace with technological innovations and new solutions for U.S. leadership. Accordingly, Ericsson asks the Commission to grant a

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<sup>5</sup> 47 C.F.R. § 2.947(f) (setting forth measurement requirements for composite systems, including that the individual devices in a composite system comply with their specific technical standards).

limited waiver of the Commission's rules so that it can manufacture and market these innovative multiband radios and so that licensees can then operate these radios on their mid-band 5G networks.

## **II. ERICSSON REQUESTS A LIMITED WAIVER OF THE COMMISSION'S RULES TO ENABLE INNOVATIVE DUAL-PASSBAND MULTIBAND DEVICES FOR THE 3.7 GHz AND 3.45 GHz SERVICES**

The multiband 3.7 GHz/3.45 GHz radio can achieve cost- and energy-efficiency by lowering the equipment footprint and combining the electronics for the two bands within common tower and remote infrastructure, without adverse impact to nearby bands. Such radios are more energy efficient through the integration of electronics and radio hardware. Additionally, the ability to support the design requirements in antennas that have 64 transmitters and receivers (64TR) allows for wider coverage, effectively serving a larger number of users for each point of presence in the deployment area and thereby reducing both the cost and the total energy expenditure of the network.

As an initial matter, Ericsson notes that Section 27.53(n) of the Commission's rules specifies the OOB limits for base stations operating in band 3.45-3.55 GHz.<sup>6</sup> Specifically, in the 3.55-3.56 GHz frequency range, the OOB limit is -13 dBm per megahertz. Then, there is a step down to -25 dBm above 3.56 GHz to 3.57 GHz. Above 3.57 GHz, base stations must conform to -40 dBm of OOB. Similarly, below 3.45 GHz, base stations must conform to an OOB of -13 dBm per megahertz until 3.44 GHz. Below 3.44 GHz, OOB may not exceed -25 dBm/MHz, and the conducted power of emissions below 3.43 GHz may not exceed -40 dBm/MHz.

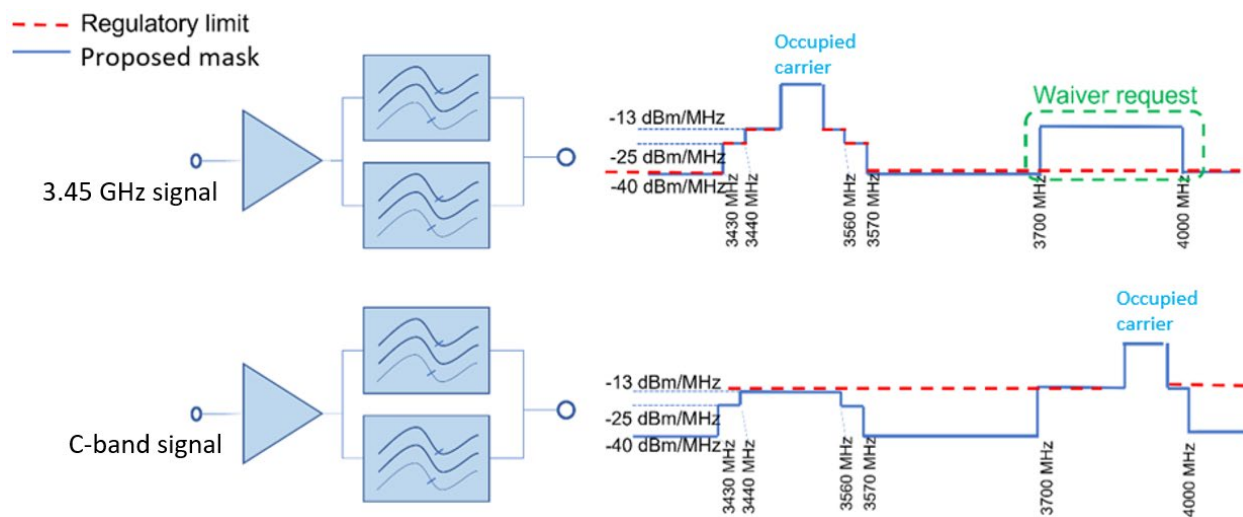
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<sup>6</sup> *Id.* § 27.53(n)(1).

**A. The Dual-Passband Filter Design Will Enable Multiband Mid-Band Radios Without Exceeding the 3.45 GHz OOB Limits in the CBRs Band and Below 3.45 GHz**

Ericsson's innovative dual-passband filter design means that a single RF power amplifier can output both the 3.45 GHz and the 3.7 GHz signals, which are then fed in parallel through two individual band-pass filters (one designed to pass 3.45-3.55 GHz and one designed to pass 3.7-3.98 GHz).

**Figure 1 – Dual-Passband Filters from Single RF Power Source**



In the top diagram in Figure 1, the blue line represents the emissions that will pass through the dual-band parallel filters when a 3.45 GHz band signal is output from the power amplifier. The red dashed line indicates the emission masks for the 3.45 GHz band.<sup>7</sup> (As noted elsewhere, the proposed multiband product will not support a 3.45 GHz standalone mode outside of conformance testing as part of the FCC's equipment authorization process.) The occupied carrier on the left shows the desired signal in the 3.45 GHz band which passes through the 3.45-3.55 GHz dual-band filter and complies with the emissions mask in Section 27.53(n) across the

<sup>7</sup> *Id.*

CBRS band and below 3.45 GHz. The occupied carrier in the 3.45 GHz band causes emissions through the 3.7-3.98 GHz filter that appear as a raised emissions level on the right of the figure. That is, the 3.45-3.55 GHz waveform is not suppressed by the dual passband filter, thereby raising emissions levels above the Section 27.53(n)(1) -40 dBm/MHz limit 3.7-4.0 GHz. These emissions, which will only occur in carrier aggregation mode with a 3.7 GHz occupied carrier, will not exceed the limits in Section 27.53(l)(1), the OOB limit that applies to 3.7 GHz Service (including for 3.7 GHz occupied carriers within the 3.7-3.98 GHz band).

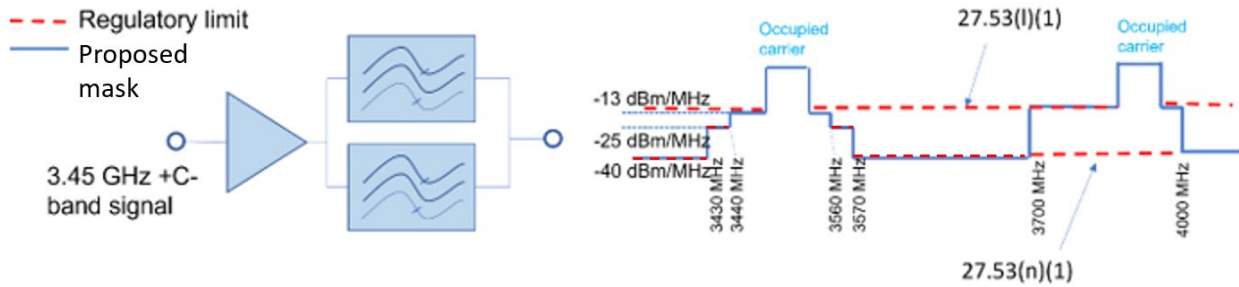
In the lower diagram in Figure 1, the blue line depicts the emissions that will pass through the dual-band filters when a 3.7 GHz band signal is output from the power amplifier. The red dashed line indicates the -13 dBm/MHz level that is required outside the licensee's authorized bandwidth.<sup>8</sup> The occupied carrier on the right represents the signal in the 3.7 GHz band which passes through the 3.7-3.98 GHz filter. The 3.7-3.98 GHz waveform is not suppressed by the filter that passes the 3.45-3.55 GHz region, thereby allowing emissions levels in the 3.45-3.55 GHz band. Even so, the signal complies with the emissions mask in Section 27.53(l).

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<sup>8</sup> *Id.* § 27.53(l)(1).



**Figure 2 – Carrier Aggregation (Commercial Operations)**



The blue line in Figure 2 depicts the emissions that would pass through the dual-band filters when both a 3.45 GHz band and a 3.7 GHz band signal are output from the power amplifier. This is the mode that would be used in commercial applications when outputting a 3.45 GHz signal. The occupied carrier on the left is the signal in the 3.45 GHz band which passes through the 3.45-3.55 GHz filter. The occupied carrier on the right is the signal in the 3.7 GHz band which passes through the 3.7-3.98 GHz filter. These emissions comply with the lower emissions mask for 3.45 GHz operations in Section 27.53(n)(1) (lower red dashed line), except in the 3.7-4.0 GHz range where the emissions comply with Section 27.53(l)(1) (upper red dashed line).

As these figures show, whether in 3.7 GHz standalone or carrier aggregation mode, the 3.7 GHz signal will have a lower emissions mask through the CBRS band than it would if it were operating in a single band base station.

#### **B. A Limited Waiver of the Commission’s Rules Would Allow Ericsson to Manufacture and Market These Innovative Multiband Devices**

Ericsson requests a limited waiver of the Commission’s rules so that it can manufacture and market these multiband radios and wireless licensees can operate them.

As a result of the dual-passband filter design, when tested for conformance with the stepdown OOB limits for 3.45 GHz band transmissions, the radio will adhere with the stepdown below 3.45 GHz and above the 3.45 GHz across the CBRS band. The figures above

illustrate that because of the dual-passband filter, the 3.45 OOB in the 3.7-4.0 GHz band will match the C-band radio OOB levels.<sup>9</sup>

All emissions will meet the 3.45 GHz Service OOB stepdown limits in the CBRN band as well as below the 3.45 GHz band. For operations involving 3.45 GHz transmissions, the radio will exceed the -40 dBm/MHz OOB limit in the 3.7-4.0 GHz frequencies. Emissions will conform to the 3.7 GHz Service rules, -13 dBm/MHz in the 3.7-4.0 GHz range set forth in 47 C.F.R. § 27.53(l)(1). Ericsson's multiband radio will require a limited waiver of the Commission's rules, specifically, the stepdown 3.45 GHz OOB limits in the 3.7-4.0 GHz frequencies, and a conforming waiver of the composite device rule.

A waiver of the stepdown 3.45 GHz Service OOB limits in the 3.7-4.0 GHz frequencies should also provide relief to the extent necessary from the composite device rule, Section 2.947(f), for 3.45 GHz because the waiver grant will change the relevant limit in the 3.7-4.0 GHz range. The Commission's "composite device" rules permit emissions measurements up to the "highest level permitted for an individual component," while requiring the "individual devices" to comply with their specific standards.<sup>10</sup> The highest OOB level permitted in the 3.7-4.0 GHz band for a 3.45 GHz and 3.7 GHz composite device is -13 dBm/MHz, which is the 3.7 GHz Service limit, but the individual technical limit for the 3.45 GHz radio in the 3.7-4.0 GHz frequencies is -40 dBm/MHz.<sup>11</sup> The waiver of the 3.45 GHz stepdown rule from 3.7-4.0 GHz would thus enable Ericsson to meet the composite device rule as to individual device compliance with its requirements.

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<sup>9</sup> *Id.* § 27.53(l).

<sup>10</sup> *Id.* § 2.947(f).

<sup>11</sup> *Id.* §§ 27.53(l)(1), 27.53(n)(1).

The only spectrum where the multiband radio's 3.45 GHz antenna emissions will exceed the 3.45 GHz band OOB limits will be 3.7-4.0 GHz, where wireless operators with licenses in both bands are eager to deploy Ericsson's multiband radio. Beyond 4.0 GHz, the 3.45 GHz OOB levels will return to the 3.45 GHz stepdown requirements but as noted, the dual-band radio will conform to the acknowledged emissions levels that Ericsson has stated regarding current 3.7 GHz Service radios' OOB levels within the 4.2-4.4 GHz band.

### **III. GOOD CAUSE EXISTS FOR A LIMITED WAIVER TO AUTHORIZE AND OPERATE THE PROPOSED MULTIBAND MID-BAND RADIO**

Ericsson respectfully requests that the Commission waive the stepdown 3.45 GHz OOB limits in the 3.7-4.0 GHz frequencies. In addition, Ericsson requests that the FCC clarify that the waiver of the stepdown 3.45 GHz OOB limits from 3.7-4.0 GHz will serve as the appropriate individual component testing limit under the composite rule or, in the alternative, grant a conforming waiver of the composite device rule.

The FCC may waive its rules where the petitioner demonstrates good cause for such action.<sup>12</sup> Good cause may be found where "particular facts would make strict compliance inconsistent with the public interest."<sup>13</sup> Further, "[t]o satisfy this public interest requirement, the waiver cannot undermine the purposes of the rule, and there must be a stronger public interest benefit in granting the waiver than in applying the rule."<sup>14</sup> In addition, a waiver request satisfies

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<sup>12</sup> *Id.* § 1.3; see also *ICO Glob. Commc'ns (Holdings) Ltd. v. FCC*, 428 F.3d 264 (D.C. Cir. 2005); *Northeast Cellular Tel. Co., L.P. v. FCC*, 897 F.2d 1164 (D.C. Cir. 1990); *WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969), *aff'd*, 459 F.2d 1203 (D.C. Cir. 1972).

<sup>13</sup> *Northeast Cellular*, 897 F.2d at 1166; *WAIT Radio*, 418 F.2d at 1157-59.

<sup>14</sup> *Spectrum Bridge, Inc. and Meld Technologies, Inc. Request For Waiver Of Sections 15.711(b)(2) and 15.711(b)(3)(ii) of the Rules*, Order, 28 FCC Rcd 13159, 13162 ¶ 12 (OET 2013) (citing *WAIT Radio*, 418 F.2d at 1157); see also *Kyma Medical Technologies Ltd. Request for Waiver of Part 15 of the Commission's Rules Applicable to Ultra-Wideband Devices*, Order, 31 FCC Rcd 9705, 9707 ¶ 5 (OET 2016).

the FCC’s public interest requirement where the waiver would serve some larger public interest objective that could not be achieved via strict application of the rule.<sup>15</sup>

**A waiver here will create public interest benefits that outweigh the benefits of strict application of the Commission’s rules.** As an initial matter, industry demand and the new radio design are consistent with the Commission’s goals for mid-band deployment. For example, the FCC recognized that commercial use of the 3.45 GHz band should “enable providers to pair 3.45 GHz spectrum with other spectrum” in furtherance of the “objectives of section 309(j) to support investment, minimize harmful interference, and align with international agreements.”<sup>16</sup> Indeed, the Commission has taken several steps in recent years to accelerate commercial use of mid-band spectrum generally.<sup>17</sup>

The proposed design has several characteristics that will make the multiband product very innovative and consistent with the FCC’s goals for mid-band deployment:

- Implementation of state-of-the-art base station solutions with 64TR capability that match wide coverage profiles;
- Simultaneous operation across key mid-band spectrum assets;
- Carrier aggregation with primary control in the 3.7 GHz band; and
- Significant savings in size on towers, energy consumption, and savings in rack space needed for radio equipment on cell sites.

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<sup>15</sup> *Id.*; see also *Deere & Company Request for Limited Waiver of Part 15 Rules for Fixed White Spaces Device*, Order, 31 FCC Rcd 2131, 2138 ¶¶ 15-16 (OET 2016).

<sup>16</sup> *Facilitating Shared Use in the 3100-3550 MHz Band*, Second Report and Order, Order on Reconsideration, and Order of Proposed Modification, 36 FCC Rcd 5987, 5995 ¶ 16 (2021).

<sup>17</sup> See, e.g., *Auction of Flexible-Use Service Licenses in the 3.7-3.98 GHz Band for Next-Generation Wireless Services; Notice and Filing Requirements, Minimum Opening Bids, Upfront Payments, and Other Procedures for Auction 107*, Public Notice, 35 FCC Rcd 8404 (2020); *Auction of Priority Access Licenses for the 3550-3650 Band; Notice and Filing Requirements, Minimum Opening Bids, Upfront Payments, and Other Procedures for Auction 105*, Public Notice, 35 FCC Rcd 2140 (2020).

The 64TR massive MIMO radio for sub-6 GHz TDD bands has clear performance advantage over other options. For example, in high-rise urban settings, a 64TR solution supports roughly 60 percent higher capacity than a solution that uses 32 transmit and receive antennas. Low-rise urban environments can likewise be covered with 10-15 percent advantage in capacity.

**Strict compliance with the rules would be inconsistent with the public interest given the alternative radio designs available for deployment.** In the absence of this waiver, a 64TR base station would require a larger circuit board, the doubling of the power amplifiers, and increased surface area for cooling flanges to accommodate the additional thermal footprint of the power amplifiers and the ASICS needed for signal processing. Such measures would result in increasing the weight of equipment and associated space needed at a cell site, because operators would need separate radios and antenna placements. In short, separate radios for the 3.7 GHz and 3.45 GHz bands would require more complexity in 5G deployment, larger space requirements at cell sites, and more energy to operate. Ericsson trains tower crews to meet the demand for 5G site installation,<sup>18</sup> and solutions that are lighter are safer to handle and take less time to install. A single piece of equipment accelerates deployment and saves space on structures, compared to multiple pieces of equipment.

The alternatives to Ericsson's innovative multiband radio would be to include two radios in the same enclosure, which increases size, weight, and cost, or to use two separate radios in separate enclosures, which increases installation costs as well as additional equipment. In

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<sup>18</sup> See Ericsson, *Ericsson USA Centers of Excellence train the 5G installation workforce*, <https://www.ericsson.com/en/about-us/company-facts/ericsson-worldwide/united-states/ericssons-training-center-of-excellence> (last visited Mar. 2, 2022); News Release, Ericsson, *Ericsson opens new Center of Excellence training facility in Texas as US focus on 5G increases* (Feb. 8, 2019), <https://www.ericsson.com/en/news/2019/2/ericsson-opens-new-center-of-excellence-training-facility-in-texas-as-focus-on-5g-in-the-united-states-increases>.

addition, using separate radios for each band (as was done for previous generations of mobile technologies) would dramatically increase the energy consumption of mobile networks. Either way, the alternatives needlessly increase the environmental impact of the radio by duplicating enclosures, drawing more power, and costing more—costs ultimately passed onto consumers. Further, in such cases, providers may have to seek local siting approval twice, wasting government as well as providers’ resources.

Here, Ericsson introduces an innovative approach that can reduce network energy use, is safer to deploy, saves space, and reduces cost. This solution can enable operator networks to use as little energy as possible while managing expected growth in data traffic—meeting the needs of both current and future 5G networks.

**The waiver would not adversely affect adjacent or nearby bands or adjacent or nearby licensees, and results in lower 3.7 GHz OOB levels, thereby not undermining the purposes of the rule.** Any 3.45 GHz emissions will adhere to the strict stepdown OOB limits throughout the CBRS band and below the 3.45 GHz band. And, this multiband radio will meet the OOB commitments Ericsson has made for 3.7 GHz Service devices with respect to emissions into the 4.2-4.4 GHz band.<sup>19</sup> The emissions from the single 3.45 GHz transmitter passing through the 3.7 GHz band filter will not exceed the OOB limit for 3.7 GHz Service licensees, -13 dBm, for other channels in the 3.7-4.0 GHz range. This reflects the Commission’s intentions in protecting all existing use of the 3-4.4 GHz region by commercial mobile users and any other services allocated to that region.

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<sup>19</sup> Letter from Mark Racek, Sr. Director Spectrum Policy, Ericsson, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (dated Jan. 7, 2022).

Notably, 3.7 GHz signals—whether in standalone mode or carrier aggregation—would operate at a lower emission mask in the CBRS band than a standalone transmitter. In other words, interference potential is reduced from a situation where a separate 3.45 GHz transmitter and 3.7 GHz transmitter are installed together. Compared to the emission limits allowed for 3.7 GHz band operations (-13 dBm/MHz), the proposed radio will generate lower OOB emissions than allowed for single-carrier base stations in the 3.7 band or even for CBRS. Specifically, the OOB limit below 3.45 GHz, throughout the CBRS band, and above 4.0 GHz from the single combined transmitter will be below -40 dBm/MHz (see proposed mask in Figure 2 above), which is less than the permitted OOB emissions from a single 3.7 GHz transmitter (the red hash marks labeled “27.53(l)” in Figure 2 at -13 dBm/MHz). The proposed radios are designed for customers that have licenses in both the 3.45 GHz and 3.7 GHz bands. Any additional emissions into the 3.7 GHz band from the proposed radio above the emission levels of any single-band 3.7 GHz base station will not have an adverse effect on entities with licenses in the 3.7 GHz band because the radios will not generate emissions in excess of the permitted -13 dBm/MHz level. The level of emissions outside of allocated channels in either band will be no worse than that allowed by regulatory limits for the corresponding band.

Given the clear public interest benefits associated with the proposed multiband radio compared to alternative and the lack of adverse effects on adjacent and nearby bands (as well as adjacent and nearby licensees), there is good cause to grant the requested waiver.

#### **IV. CONCLUSION**

For the foregoing reasons, Ericsson respectfully requests the Commission to waive Section 27.53(n) of its rules from 3.7-4.0 GHz so that Ericsson can manufacture and market multiband radios in mid-band spectrum that use a dual-pass filter design. Out of an abundance of caution, Ericsson also requests a conforming waiver of Section 2.947(f) to allow the device to

be equipment authorized and then operated pursuant to a limited waiver of Section 27.53(n).

The Race to 5G is on. Ericsson requests that the FCC expedite this request to allow innovative, multiband devices into 3.45 GHz and 3.7 GHz as quickly as possible.

Respectfully submitted,

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